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(71)(72) Applicant and Inventor: MARTINEZ, Celso, Jr. [BR/BR]; Avenida Dr. Carlos Botelho, 3020, CEP-13560-251 São Carlos, SP (BR).

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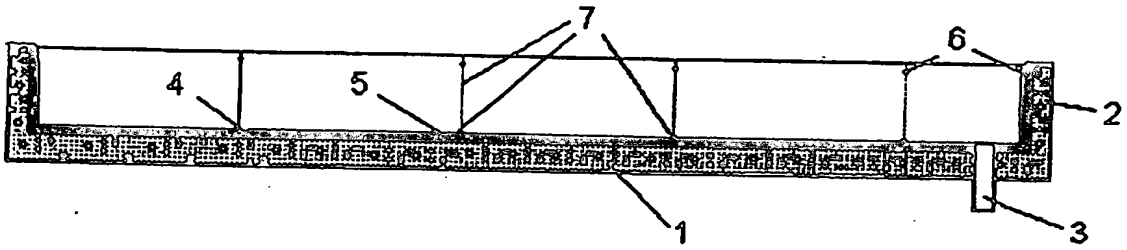
(54) Title: A ROOF WATERPROOFING SYSTEM CONSISTING OF AN ORGANIC RESIN PROTECTED BY AN ALUMINUM-COPOLYMER COMPOSITE FOIL



(57) Abstract

The present Utility Model, that conjugates in one system two processes that confer watertightness to exposed substrates, cimentitious or not, used on roofs of current buildings, provides larger reliability to the surfaces against the percolation of water. The said system is constituted of applying, on exposed porous or non-porous surfaces (1), mud slab regularized or not, of concrete, wood, metals, etc., besides baseboards or parapets (2), of high adherence organic resin (4), with self-leveling, viscoelastic, thermoplastic and hydrophobic properties, covered by film strips (5) of aluminum laminated with thermoplastic copolymers, welded at its overlaps (7) by thermal process, fastened in the vertical surfaces of the structures by screws/plastic washers/expansion shells groups (6), and whose flow of rain water is made by pipeline (3) in PVC or other equivalent material.

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"A ROOF WATERPROOFING SYSTEM CONSISTING OF AN ORGANIC RESIN PROTECTED BY AN ALUMINUM-COPOLYMER COMPOSITE FOIL ".

The present Utility Model is related to a technique for protection of exposed building roofs, consisted of cementitious (or not) substrate, against percolation of water, that conjugates, in one system, two processes that confer watertightness to the roof, providing larger reliability to the surfaces against the percolation of water.

At present, the factory-prepared systems which are destined to obtain roof watertightness (except the conventional roofs in clay tile, fiber-cement or metallic elements) are mainly constituted of prefabricated asphalt-based, asphalt-elastomeric or pure elastomeric impermeable films.

The factory-prepared asphalt-based and asphalt-elastomeric sheets have usually an internal reinforcement provided by polyethylene films, non-woven polyester or non-woven fiberglass. Elastomeric films, particularly the fluid-applied elastomers, do not usually contain reinforcement in its interior, although some polymeric manufactured sheets do it to provide added strength and puncture resistance. These films are applied on a structural substrate (e.g. concrete slabs), sometimes regularized by cimentitious mortar. The mortar is used to create a surface free from angular points and depressions besides granting suitable slope for water flow.

Some of these materials are applied to the mud slab through previous application of an appropriate asphalt-based primer, used to fix the films strongly to the substrate. Primer is cold-applied, but film attachment to the primer is executed, often times, through hot-process, by means of a torch.

In order to protect the film against the deleterious effect of ultraviolet rays, some roofing materials show, in one of their faces, an element in order to impede such effect

on the asphalt-based material. Usually, this element comprises an appropriate elastomer (Patent at USPTO under number 4,775,567: "A waterproofing laminate suitable for use in roofs, floors, or other surfaces where waterproofing is desired, comprises an elastomeric sheet secured to a modified bitumen layer and a release sheet secured to the modified bitumen layer. Certain preferred materials for use in the laminate are recited."), crushed slate powder, or thin aluminum film facing, surfacing one side of the asphalt-based sheet.

These prefabricated sheets are meant for roofs with eventual or sporadic traffic, usually necessary for maintenance or cleaning operations. Such facing materials do not give mechanical protection to the sheets, but they do protect them against the incidence of ultraviolet solar rays. On the other hand, infrared rays are also reflected by the aluminum facing, improving thermal comfort conditions on the environment protected by the referred sheets.

There are, still, factory-prepared asphalt-elastomeric membranes, in which one face presents self-adhesive finish and the other face receives, as in the previous case, a thin film facing of aluminum. (Patent at USPTO under numbers 4,936,938; 5,096,759 and 5,142,837 – "A laminated roofing material includes an aluminum foil top sheet laminated to a polyethylene film by an ionomer resin. After the sheets are bonded together they are cooled to set the resin and an asphalt (bitumen) coating is applied to the exposed polyethylene sheet and covered with a release paper. The roofing material is applied over an underlayment to form a roof supported by conventional sheeting material.")

Such a material has several applications in the building construction sector, as for example, the recovery of metallic roofs which present leakage caused by oxidation and consequent perforation of the roof metallic cover. In this case, primers are not

used, as one of the material faces already has an adhesive element, provided that the substrate is absolutely clean and dry to promote attachment.

The main disadvantage in the case of the aluminum-faced membranes resides in the low mechanical resistance of the coating on the exposed face. As the aluminum film is extremely thin (about 35 to 50 micrometers), it is subject to the damaging mechanical actions which may expose the asphalt-based portion of the membrane to the ultraviolet solar rays.

Another quite common occurrence in the usage of asphalt-based or elastomeric sheets to building construction roofs is the difficulty to locate eventual defects that could lead to watertightness failure. The infiltration can be caused by a flaw in lateral or longitudinal welding of the membrane strip overlaps or even by involuntary perforation in the sheet. Water penetrates through the flaw, reaches the mud slab and percolates the interior of its porous matrix under the roofing membrane, till it finds a defect in the cimentitious substrate (e.g. a joint, a "bug hole"), making the leakage visible on the inside of the building. Most of the time, the point at which the leakage becomes visible does not coincide with the position of the failure which caused the leak. Moreover, as primer attaches the sheet firmly to the deck, in case a dynamic crack appears in the substrate due to structural movements (e.g. severe climatic thermal gradients), the new joint will probably propagate to the roofing material, splitting it at this position and allowing water to enter the split.

With the objective of solving such inconveniences, the present system was developed, through which substrate watertightness is assured by two processes: first, an organic, flexible, hydrophobic, self-leveling and viscoelastic composition resin is applied directly on the structural substrate to be treated, sealing the pores in its surface; second, an impermeable aluminum foil laminated with thermoplastic copolymers is adhered to the surface by the organic resin.

The advantages of this system when compared to the existing ones are as follows: a) it offers relatively large resistance to involuntary mechanical injuries on the foil, due to the presence of larger film thickness (about 300 micrometers); b) its watertightness results from two different processes: in the hypothesis that a severe mechanical injury causes foil perforation, the structure will stay tight as its pores remain sealed by the organic resin action; c) the fact that the system permits being applied directly over the concrete deck structure, eliminating the need of previous execution of mud slab, which is indispensable in the prevalent waterproofing systems, and leading to greater economic feasibility; d) the system can also be applied over mud slab substrates, although direct application on concrete deck structure is preferable; e) the ease and economy in the location of the leak-causing flaw, when flood test is in progress, if the proposed system is applied directly on the concrete deck structure; and, f) the resin, being viscoelastic, allows reasonable adherence of the film composite to the substrate, admitting the possibility of small sliding between them; this characteristic is the one responsible for the integrity of the film in the circumstance of a dynamic crack arise on the deck, as such crack is not transmitted to the film, since it slides on the resin layer without breaking, differently from asphaltic or asphalt-elastomeric sheets which are intimately stuck to the substrate by means of primers.

The invention can be better understood through the following detailed description, in consonance with the drawing enclosed, where:

ILLUSTRATION 1 shows the plan of a surface on which the proposed system was applied.

ILLUSTRATION 2 shows the longitudinal section of a surface on which the proposed system was applied.

ILLUSTRATION 3 shows the traverse section of a surface on which the proposed system was applied.

With regard to these illustrations, it can be observed that the organic resin (4) is applied over the deck structure (1) and its baseboards or parapets (2). This resin (4) has high attachment power to porous and non-porous substrates, besides having self-leveling, hydrophobic and viscoelastic characteristics; in the specific case of the porous substrates, the material sticks to the surface, penetrating the external capillaries of the porous matrix and sealing them. Therefore, this material turns the porous surface totally impervious to water and, as the resin is highly flexible, it allows deck's small structural movements without loosing watertightness.

Over the substrate, previously treated with the mentioned resin, a composite film (5) of aluminum laminated on both faces with thermoplastic copolymers is applied in a way so as to protect the resin against the harmful action of ultraviolet solar light. The welding (7) of the several strips of the composite, in the longitudinal direction, is done by the application of heated air, through appropriate equipment and temperature, in the overlap interface of two adjacent strips. The copolymer which laminates the aluminum foil is thermoplastic and allows to be melted with heated air, attaching the adjacent sheets on the overlapping strip. No bonding materials are needed for this purpose.

For better fastening of the composite strip edges to the deck, screws are used (6), endowed with plastic washers, attached in common expansion shells that are introduced inside appropriate holes, performed in the structure of the baseboards and parapets (2).

The rain water, collected on the treated surface, flows through a pipeline (3) in PVC or other material destined for that purpose.

CLAIMS

1st) " A ROOF WATERPROOFING SYSTEM CONSISTING OF AN ORGANIC RESIN PROTECTED BY AN ALUMINUM-COPOLYMER COMPOSITE FOIL ", characterized by the application, on exposed porous or non-porous surfaces (1), mud slab regularized or not, of concrete, wood, metals, etc., besides baseboards and parapets (2), of high adherence organic resin (4), with self-leveling, viscoelastic, thermoplastic and hydrophobic properties, covered by film strips (5) of aluminum laminated with thermoplastic copolymers, welded at its overlaps (7) by thermal process, fastened in the vertical surfaces of the structures by screws/plastic washers/expansion shells groups (6), and whose flow of rain water is made by pipeline (3) in PVC or other equivalent material.

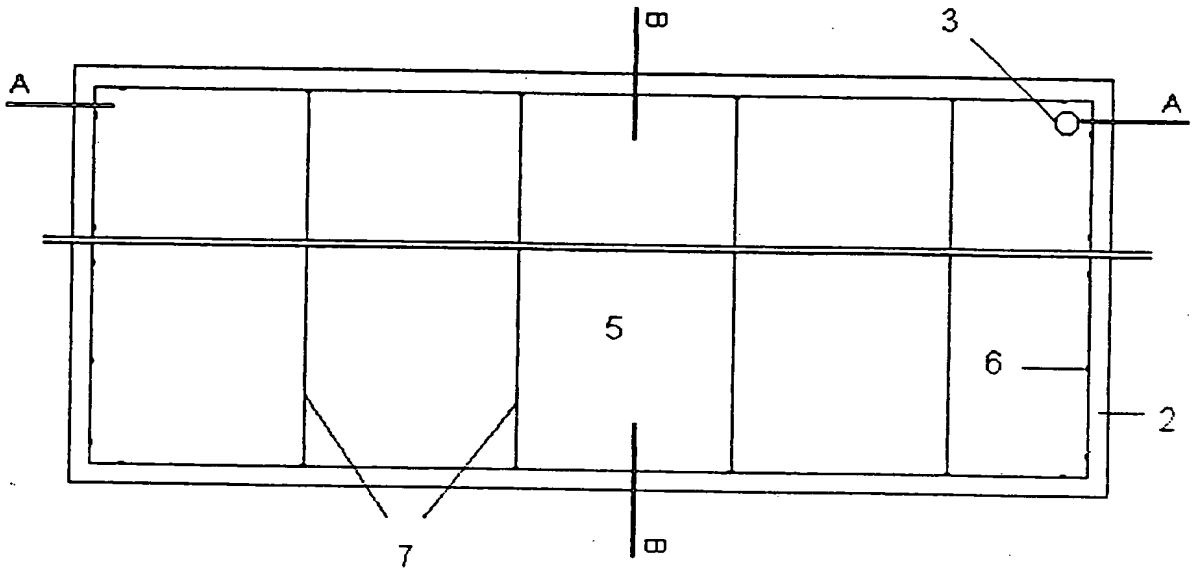

ILLUSTRATION 1

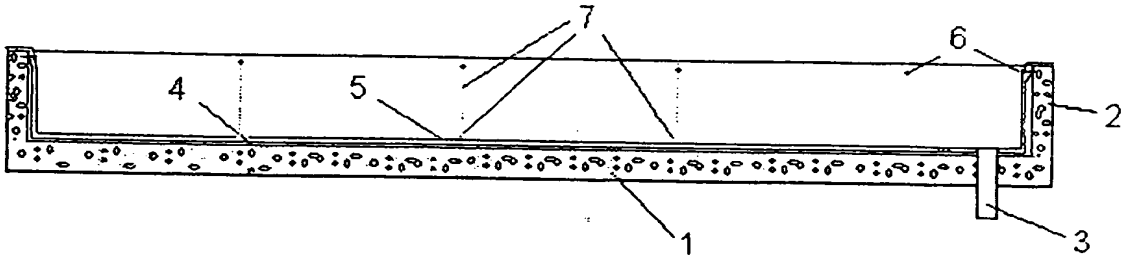

ILLUSTRATION 2

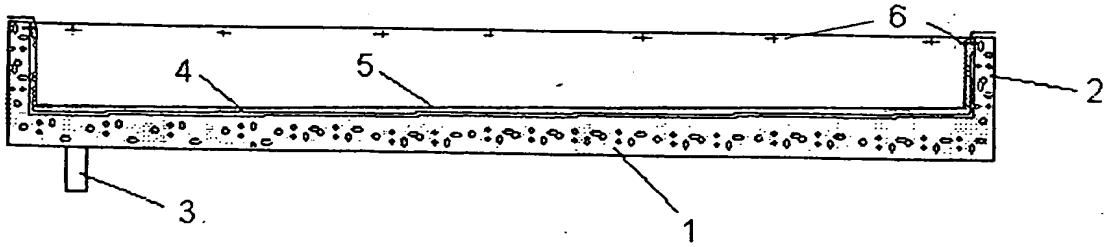

ILLUSTRATION 3

INTERNATIONAL SEARCH REPORT

In ational Application No
PCT/BR 98/00053

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E04D11/02 E04D5/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E04D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 473 610 A (DAVIS) 25 September 1984 see column 1, line 45 - column 2, line 3; figures ---	1
A	WO 89 08135 A (SCHAUMANN) 8 September 1989 see page 3, paragraph 3 - page 4, paragraph 1; figures ---	1
A	US 5 096 759 A (SIMPSON ET AL.) 17 March 1992 cited in the application see column 1, line 40 - column 2, line 4 see column 3, line 1 - line 36; figures ---	1
A	WO 97 03258 A (GENTEK BUILDING) 30 January 1997 see page 8, line 3 - line 34; figures --- -/--	1

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 November 1998	30/11/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Righetti, R

Form PCT/ISA/210 (second sheet) (July 1992)

6

INTERNATIONAL SEARCH REPORT

In. .ational Application No
PCT/BR 98/00053

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document. with indication.where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 065 155 A (TOYO KOHAN) 24 June 1981 see page 1, line 28 - line 35	1
A	FR 2 554 484 A (GENERAL ELECTRIC) 10 May 1985 see abstract; figures	1
A	FR 2 222 514 A (CHEM. WERKE HÜLS) 18 October 1974 see example 6	1
A	GB 2 244 735 A (R. H. EMBERSON ET AL.) 11 December 1991 see abstract; figures	1
A	GB 2 105 256 A (COAL INDUSTRY) 23 March 1983 see abstract; figures	1

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ational Application No
PCT/BR 98/00053

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4473610 A	25-09-1984	NONE	
WO 8908135 A	08-09-1989	DE 3806480 A	14-09-1989
		AU 3189089 A	22-09-1989
		EP 0403510 A	27-12-1990
		JP 3502939 T	04-07-1991
US 5096759 A	17-03-1992	US 4936938 A	26-06-1990
		US 5142837 A	01-09-1992
WO 9703258 A	30-01-1997	US 5670244 A	23-09-1997
		AU 6675396 A	10-02-1997
GB 2065155 A	24-06-1900	DE 2950994 A	25-06-1981
		FR 2471859 A	26-06-1981
FR 2554484 A	10-05-1985	NONE	
FR 2222514 A	18-10-1900	DE 2314750 A	10-10-1974
		BE 812744 A	15-07-1974
		GB 1454845 A	03-11-1976
GB 2244735 A	11-12-1991	NONE	
GB 2105256 A	23-03-1983	NONE	

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

MARTINEZ, Celso Junior
Avenida Dr. Carlos Botelho, 3020
13560-251 Sao Carlos-Sp
BRESIL

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing *(day/month/year)*	11. 11.98
Applicant's or agent's file reference ---------	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/BR98/00053	28/07/1998	29/07/1997

Applicant
MARTINEZ, Celso, Jr.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Himmel, U Tel.+49 89 2399-2876

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/BR98/00053	28/07/1998	29/07/1997
International Patent Classification (IPC) or national classification and IPC E04D11/02		
Applicant MARTINEZ, Celso, Jr.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
18/02/1999	11. 11. 99
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Kofoed, P Telephone No. +49 89 2399 2927

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/BR98/00053

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-6	as received on	29/06/1999	with letter of	24/06/1999

Claims, No.:

1-3	as received on	29/06/1999	with letter of	24/06/1999

Drawings, sheets:

1/1	as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1-3
	No:	Claims
Inventive step (IS)	Yes:	Claims 1-3
	No:	Claims
Industrial applicability (IA)	Yes:	Claims 1-3
	No:	Claims

2. Citations and explanations

see separate sheet

Re Item I

Basis of the opinion

1 The amendments filed with the letter dated 29.06.1999 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.

1.1 The amendments concerned are the following: Newly filed claim 1 (see lines 6, 7, 9, 11) contains other features than those in the original claim 1:

a) - surfaces (1) smoothed or not instead of
surfaces (1) mud slap regularized or not

b) - surfaces (1) lack surfaces (1) of concrete, wood, metal etc.

c) - piping (3) lacks pipeline (3) in PVC or other equivalent material

d) - viscous-plastic resin (4) instead of
viscoelastic resin (4)

e) - resin (4) lacks selfleveling resin (4)

f) - bolts/bushings/washers (6) instead of
screws/plastic washers/expansion shells groups (6)

1.2 These alternative features imply a broadening and/or a change in protection of the claim. There is no basis in the application for these changes. The applicants argument dated 16.10.1999 cannot be agreed on:

1.2.1 The points a,b,c represent broadenings; f a simple change.

1.2.2 Points d & e: The original word *viscoelastic* implies an ableness to exhibit both viscous and elastic behaviour, in an intermediate state between plastic and elastic behaviour. The missing word self-levelling also helps to indicate these features.

1.3 Claim 2 discloses "relative displacements" in lines 19-20 whereas the original description mentions "small sliding" and "small structural movements", see page 4, line 14 and page 5, lines 9 -10, respectively. There is also no basis for the resin being "viscous-plastic" in line 19.

1.4 Therefore, the complete set of newly file claims 1 to 3 is in conflict with Article 34(2)(b) PCT.

1.5 This comment also applies for parts of the description, see e.g. page 3, line 13:

- ca. 35 micra instead of about 35-50 micrometers

2 The following statements with regard to Article 33 PCT have been established on the new claims as if the above underlined amendments had not been made (Rule 70.2(c) PCT).

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

3 Reference is made to the following documents:

D1: WO-A-97 03258
D2: US-A-4 473 610

4 The invention concerns protection for exposed building roofs against the percolation of water by applying an organic resin protected by a composite of aluminium alloy with thermoplastic copolymers according to the preamble of claim 1.

5 The subject-matter of claim 1 is new and inventive for the following reasons (Articles 33(2)&(3) PCT):

The problem to provide a watertight roofing is solved according to claim 1, in which the protection is achieved thanks to two processes: 1) application of a viscoelastic resin over a surface and 2) covering by strips of composite made of coated aluminium alloy.

5.1 Coated metal sheets for outdoor building materials are rather conventional, the abstract and claims 1 and 2 of document D1 disclose a multi-layer aluminium composite comprising an aluminium foil carrying a polymer surface coating. However, this composite is destined to explicitly to siding and not to roofing application.

5.2 Document D2 shows in figure 1 the fastening of an aluminium foil (17) to a wooden board (13) by resin (15) with the effect of flexibility in cold and hot weather and no cracking (see D2 column 1, lines 10-17), i.e with the same advantages as mentioned in the present application. But, this document lacks to specify the engineering properties.

Hence, there is no indication for the skilled man to combine these documents, and further a combination would not lead to the full invention. The requirements of Articles 33(2)&(3) are therefore fulfilled, the subject-matter of claim 1 is new and based on an inventive step.

5.3 The industrial applicability is also given (Article 33(4) PCT).

6 The claims 2 and 3 concern further advantageous developments of the protection according to claim 1. They are new, inventive and industrial applicable (Article 33 PCT).

Protection for exposed building roofs against the percolation of water, by application of an organic resin protected by a composite of an aluminium alloy lined with thermoplastic copolymers.

The present Utility Model relates to a technique for protection of exposed building roofs, comprised of cementitious structures or not, against the percolation of water, that combines in a single system two processes providing watertightness to the substrate, thereby providing a higher degree of reliability to the surfaces treated through this method, against the infiltration of water.

The prefabricated systems currently intended to provide watertightness to roofs, excluding the conventional ceramic tile, fibre cement or metallic roofs, comprise mainly a prefabricated impermeable sheet of asphalt, asphalt-elastomeric or purely elastomeric base.

The asphalt and asphalt-elastomeric prefabricated sheets are usually reinforced internally with polyethylene films, polyester non-woven geotextiles or fiberglass non-woven textiles. The purely elastomeric sheets, particularly those molded on the site, usually do not present a reinforcement therein, even though some prefabricated polymer sheets are provided with reinforcement to provide additional tensile strength and perforation resistance. These materials are applied on a structural substrate (for example, concrete slabs), usually smoothed by a cementitious mortar, which is intended to provide a surface free of angular points and depressions, in addition to providing a proper slope for water flow.

Some of these materials are firmly adhered to the substrate by previous application of an appropriate asphalt primer. The primer is cold-applied, but the film attachment to the primer is most of the times hot-applied, by

utilization of LPG (liquid petroleum gas) torches.

Most of the systems having these characteristics receives a mechanical protection layer, usually made of a cement and sand mortar over the asphalt or elastomeric sheet, with interposition therebetween of an insulation known as "separating layer"; in these cases, these are roofs subject to the permanent transit of people or vehicles. In addition to preventing damage of mechanical nature to the watertight lining, such protection is intended to protect the sheet from the deleterious action of ultraviolet light.

However, there are self-protected, prefabricated asphalt or asphalt-elastomeric sheets intended to roofing for appropriate purposes. No protection mortar is applied over these sheets. They are provided on one of the faces thereof with some element intended to prevent the action of ultraviolet light on the asphalt material. Usually, this element comprises an appropriate elastomer (U.S. Patent 4,775,567), crushed slate dust, or a thin aluminium lining applied on one of the surfaces of the prefabricated asphalt sheet. These prefabricated sheets are intended for use on roofs having an eventual or sporadic transit, usually required for maintenance or cleaning operations thereof. Such linings do not provide mechanical protection to the sheets, but protect them against the solar rays, significantly contributing to protect them against the degrading action of ultraviolet light. On the other hand, the infrared light is also reflected by the lining, where the latter is made of aluminium, which improves the thermal comfort conditions of the environment protected by said system.

There are also prefabricated asphalt-elastomeric sheets wherein one of the faces thereof is provided with a self-adhesive finish and the other faces is provided with a thin aluminium foil, as in the previous case (U.S. Patents

4,936,938; U.S. 5,096,759 and U.S. 5,142,837).

Such material finds various applications in the Civil Construction segment, one of them being the repair of metallic roofs presenting infiltration caused by perforation of the tiles by oxidation. In this case, the primers are not employed, since one of the faces of the material is already provided with an adhesive element, and in order to promote the adhesion, it suffices that the substrate is properly clean and dry.

The main drawback in the case of aluminized sheets, lies on the low mechanical strength of the lining on the upper (exposed) face. Since the aluminium foil is extremely thin (ca. 35 micra), it is subject to mechanical action that may damage it, thereby exposing the asphalt portion of the sheet to the action of ultraviolet light.

Another quite common event in the application of alphalt or elastomeric sheets on building roofs is the difficulty in locating eventual defects causing loss of watertightness. The infiltration may be caused by a fault in the lateral or longitudinal welding between the sheets strips or even by involuntary perforation thereof. The liquid penetrates through the fault and travels by percolating inside the porous matrix of the smoothing layer, if any, until it finds a defect in the cementitious substrate, immediately below the smoothing layer (a fissure, concrete gap, etc.), through which the infiltration will become visible inside the building. In most of the cases, this visible point does not coincide with the position of the defect that has caused it. In addition, since the primer firmly and closely adheres the sheets to the substrate, in the event of occurrence of a dynamic fissure in the structure, caused by structural movement (for example, high weather thermal gradients), the new fault will propagate

itself to the roofing material. This intimate adhesion between the conventional sheets and the substrate does not allow a relative displacement therebetween. Accordingly, new dynamic cracks or fissures appearing on the substrate will propagate to the sheet in an extremely restricted region (in a line along the fissure) and, as a result, will cause the rupture thereof, since the specific deformation on this line will have a very high modulus, beyond the material's ability of absorbing it, and will crack the latter, thereby allowing the penetration of water through this crack.

The system developed, subject matter of the present Utility Model, solves such drawbacks, in addition to providing other advantages arising out of the conception thereof, through which the substrate's watertightness is generated by two processes: first, an organic composition resin is applied directly over the substrate structure to be treated, thereby sealing the pores on the surface thereof (it the event that it is porous); second, a composite comprised of an aluminium alloy lined with thermoplastic copolymers is adhered to the surface of the organic resin. Such system will be best understood through a description of the figures, which represent, in an schematic manner:

FIGURE 1 - plan of a surface to which the system in question has been applied.

FIGURE 2 - longitudinal cross-section of a surface to which the system in question has been applied.

FIGURE 3 - transversal cross-section of a surface to which the system in question has been applied.

With reference to these figures, it can be observed that the organic resin (4) is applied on the deck structure (1) and its baseboards or parapets (2). This viscous-plastic resin (4) has a high adhesion power to porous and non-porous substrates, in addition to being thermoplastic and

hydrophobic; in the specific case of porous substrates, the material adheres to the respective surface, penetrating the outer capillaries of this porous matrix and sealing them. Accordingly, said material renders the porous surface entirely watertight, by means of viscous-plastic blocking of its porosity.

On the substrate previously treated with said resin, a composite (5) comprised of an aluminium alloy lined on both faces with thermoplastic copolymers is applied so as to protect the resin from the deleterious action of ultraviolet light. The welding (7) of the several strips of this material in the longitudinal or transversal direction, is done by application of hot air, by means of appropriate equipment and temperature, at the overlapping interface of two strips of said material. The copolymer lining the aluminium alloy is thermoplastic and can be melted with hot air, adhering the adjacent sheets by means of the overlapping band. No adhesion material is required for this purpose.

In addition, due to the fact that the resin is viscous-plastic, it allows relative displacements between the composite and the substrate, so that eventual cracks or fissures occurring in this substrate by reason of deformations of thermal or mechanical nature will not propagate with the same intensity to the lining in question. In this case, the relative displacement effect provides that the deformations caused by fissures are absorbed by a large strip of the composite material. Accordingly, the specific deformation of the lining in this region will be very small, perfectly bearable thereby, and will be absorbed without rupture, ensuring a permanent watertightness.

The fact that the watertightness is generated by two distinct processes increases the reliability of this method, since in the event of a mechanical action causing a

perforation in the lining composite, even then the structure will remain watertight, since the pores thereof have been sealed by action of the organic resin.

For a better attachment of the ends of the composite strips to the substrate, bolts (6) provided with plastic washers are employed, attached to ordinary bushings introduced in appropriate orifices for this purpose, and made on the structure of the baseboard and parapets (2).

The water collected on the treated surface flows through a weldable PVC rainwater piping (3) or other material intended for that purpose.

The present model presents the following advantages:

a) a great resistance to involuntary mechanical action on the lining, achieved by the thickness of the composite employed (ca. 300 micrometers);

b) the fact that the system can be directly applied on the deck structure, dispensing with the smoothing layer, usually employed in the current systems, which makes it more economically feasible;

c) the fact that the system can be applied also on smoothed substrates, even though the preference is for direct application on said structure; and

d) ease and economy in the location of the event generating an eventual infiltration, at the time of performance of watertightness test, if the proposed system is applied directly on the structure.

CLAIMS

1.- Protection for exposed building roofs against the percolation of water, by application of an organic resin protected by a composite of an aluminium alloy lined with thermoplastic copolymers, for application over porous or non-porous exposed surface (1), smoothed or not, including baseboards or parapets (2) attached to the vertical surfaces of the structures by sets of bolts/bushings/washers (6), allowing the rainwater flow by means of a piping (3), characterized in that it is comprised of a highly adhesive, viscous-plastic, thermoplastic and hydrophobic organic resin (4) covered by strips of composite (5) made of aluminium alloy lined by thermoplastic copolymers, welded at the overlapping thereof (7) by means of a thermal process.

2.- Protection for exposed building roofs against the percolation of water, by application of an organic resin protected by a composite of an aluminium alloy lined with thermoplastic copolymers, as claimed on 1, characterized in that the resin (4), by being viscous-plastic, allows relative displacementes between the composite and the substrate, so that eventual cracks or fissures occurring in that substrate, caused by deformation of thermal or mechanical nature do not propagate to the lining in question with the same intensity, thereby ensuring a permanent watertightness.

3.- Protection for exposed building roofs against the percolation of water, by application of an organic resin protected by a composite of an aluminium alloy lined with thermoplastic copolymers, as claimed in 1 and 2, characterized in that the watertightness is generated by two distinct processes that in the event of a severe mechanical action causes a perforation of the composite lining, provide a permanent watertightness, due to the action of the resin, that seals the structure surface pores.

AMENDED SHEET

ABSTRACT

Protection for exposed building roofs against the percolation of water, by application of an organic resin protected by a composite of an aluminium alloy lined with thermoplastic copolymers.

The present Utility Model refers to a technique for protection of exposed roofs which in a single system conjugates two processes to generate watertightness for exposed substracts, cementitious or not, providing a better reliability to the treated surfaces against water infiltration, by means of this system.

Said System comprises the application on porous or non-porous exposed surfaces (1), smoothed or not, including the corresponding baseboards or parapets (2), of a highly adhesive organic resin (4), characterized in that it is viscous-plastic, thermoplastic and hydrophobic, covered by composite strips (5) of an aluminium alloy lined with thermoplastic copolymers, welded at the overlapping (7) thereof by means of a thermal process, attached to the vertical surfaces of the structures by sets of bolts/bushings/washers (6) and wherein the water discharge takes place by means of a rainwater drainage piping (3).